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71 Applicant: **MONSANTO CANADA INC.**
P.O. Box 787 2330 Argentia Road Streetsville
Mississauga Ontario, L5M 2G4 (CA)

72 Inventor: **Whiteley, Joseph D.**
97 Janefield Avenue
Guelph Ontario N1G 2L4 (CA)

74 Representative: **Rostovanyi, Peter et al**
AWAPATENT AB Box 5117
S-200 71 Malmö (SE)

54 **Fire stop device.**

57 There is provided a fire stop device having a closure for a conduit passing through an aperture extending through a wall, floor or the like. Fire resistant movable closure means are operatively associated with the aperture. The closure means are movable between a first retracted position and a second functional position wherein the aperture is closed-off by the closure means. Self-sustaining restraining means of a heat disposable low-temperature melting metallic substance are used, the material being dispersible into a non-sustaining form when heated above the melting temperature thereof. The restraining means retains the closure means in the first position while permitting it to move to the second position when the substance is dispersed upon being heated. Means are also provided for normally urging the closure means in the second position. Thus normally combustible thermoplastic conduits can be used up to the fire stop without affecting its operation.

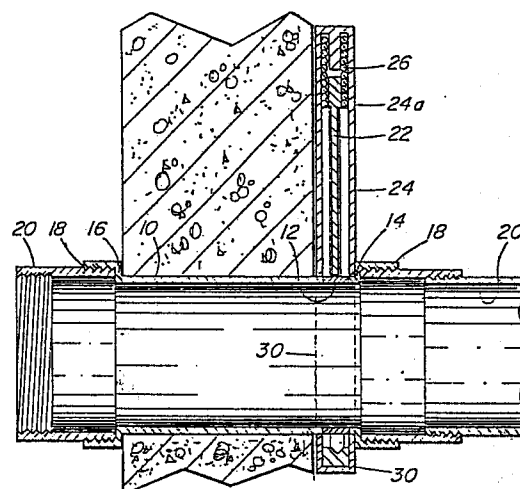


FIG. 1

Description

This invention relates to fire stop devices operable in a vertical, inclined or horizontal orientation.

Certain types of fire stop devices are known, e.g. US 4,136,707 Jan. 30/79 teaches a fire-resisting device for pipes between floors or walls. A first plastic pipe extends inwardly of a wall aperture to meet a sleeve of fusible material located within the wall and a further plastic pipe mates on the opposed wall side with the sleeve.

A pair of swinging gates held in place by the plastic pipes are released when the plastic piping is consumed by a fire, and the gates then close with the release of a swellable mass to block-off the opening behind the gates. Such an arrangement is only practical for vertical applications as the gates depend on gravity for closure once the plastic conduits are consumed. Modifications are required as taught to use the arrangement in an other than vertical orientation.

US 3,678,634, July 25, 1972 discloses a fire stop where a plastic pipe extends through a wall; a pair of opposed tensioned gates are mounted on the side of the wall bear against the plastic pipe by means of coil springs. In use, when fire contacts the plastic pipes, the pipes will soften and collapse due to the urging of the gates against the softened plastic; the plastic pipe is "squeezed" in the softened areas so that sections of the plastic pipe come together by the force of the opposing gates (Figure 5).

US 3,462,890 teaches a fire stop with a sliding blade arrangement to cut through a plastic pipe extending through a fire-wall, when softened by the heat. In one form, a weight is used to provide force on a plastic pipe to cut it; in another form, the blade is constantly urged against the plastic pipe by means of a tension spring.

Fire stops have also been proposed where a standard "wye" plumbing fitting is provided with a metallic plug in a branch outlet, the plug being fitted by a thermoplastic harness which upon melting, allows it to fall into the flow path to block the pipe opening. Special spacing and installation requirements are needed to make this device effective.

Another proposed device uses an intumescent type reaction to heat as a fire stop, requiring expensive specialized chemicals or materials. Such devices are heat sensitive and also generally sensitive to carbon dioxide and/or moisture sometimes becoming prematurely inoperable.

Disadvantages of fire stops (as in the above United States Patents) require thermoplastic pipes to collapse or to be severed during a fire or which use intumescent type reactions to heat, and that they can fail due to long storage as well as being susceptible to ordinary atmospheric conditions. Many prior art devices also only function in either a vertical or horizontal mode;

With the introduction of thermoplastic conduits, it has been proposed (e.g. above US patents) to permit such thermoplastic conduits to extend through walls or floors and form a continuation of the

plastic conduit or duct that is otherwise used. However, many building codes prohibit this, eliminating the possibility that the thermoplastic conduit (normally a combustible material) be continuous where a fire separation is required even though a fire stop device is used, since flames and combustion products can pass through such fire stop devices particularly in a horizontal fire separation or when there is a pressure differential across the fire separation zone. In other cases, the disadvantages of utilizing a continuous thermoplastic material through a fire separation zone are due to the softening characteristics of the thermoplastic materials, based on the location and intensity of a potential fire, which are critical to the operation of a fire stop device; it is well known that a thermoplastic conduit may collapse in a non-symmetrical manner thus causing the closing blades or the like of the fire stop device to become misaligned and prevent full closure.

The softening point of thermoplastic materials extends over a wide range - e.g. 90°C to 315°C, which provides an undesirable time delay before the fire stop device becomes actuated. Also, when the thermoplastic material softens, and before it burns, fire stop devices may compress the softened thermoplastic conduit into a large mass by virtue of the softened material becoming deformed (also due to the action of gravity) and unless the fire stop device is capable of severing the mass of softened material, combustion of the thermoplastic material may actually be transmitted along the length of the thermoplastic material thus by-passing the fire stop.

Most thermoplastic pipe materials have inherent properties so that they have long term "creep" due to continuous stress; and physical failure (even without a fire) can occur. Expensive repairs or replacement are required, and a device may fail to serve its primary function when needed.

The use of thermoplastic materials e.g. ABS, PVC, or the like in conduits for residential, industrial or commercial buildings is increasing. There is thus a need for a fire stop system meeting the following parameters:

- operable in any orientation;
- meet building codes so that no combustible material is present in the fire separation zone and negligible amounts in the balance in other parts with the further requirement that any large mass of combustible thermoplastic material must be terminated prior to reaching a fire separation;
- must have a proper action over a wide temperature range regardless of the condition or age of the thermoplastic material used in the conduits;
- and further, must not be influenced by any long term creep or environmental characteristics of the installation which would otherwise impair their function.

In view of the diversity of application of fire stop devices, e.g. in plastic conduits carrying telephone or communication cables (e.g., optic fibre cables or

the like) or even in pressurized conduits, plumbing conduits, e.g. sanitary drain, water supply, etc., air-conditioning conduits, etc. such fire stop devices may not only have to operate under pressure, but also provide an effective stoppage of the flow of the contents being transported or carried by the conduits.

Various codes are provided for fire stops; e.g. plastic conduits may be prohibited in or between walls, exiting from a wall, etc. due to the potential fire spread through the conduit and lack of an effective fire stop. It would therefore be desirable if an effective fire stop could be provided to permit plastic conduits to extend between walls.

This invention provides an improved fire stop device which, due to the nature of the material and the structure employed to ensure that positive control is obtained to permit the device to function without the problems associated with, e.g., the above-described arrangements having thermoplastic materials.

One embodiment provides for a building structure having a structural opening requiring fire stop protection and the improvement wherein the opening has a movable fire-resistant barrier dimensioned to at least substantially cover the opening which can be moved from a first non-protective position to a second protective position, in combination with restraining means retaining the fire resistant barrier in a first non-protective position, the restraining means comprising a heat-disposable low temperature melting metallic substance, the substance being dispersible into a non-sustaining form when heated above the melting temperature thereof to release the fire resistant barrier to permit the same to move into the second protective position.

There is also provided a fire wall structure suitable for closure of a conduit passing through the firewall having an aperture extending therethrough (e.g. a wall, floor, etc.), the structure having a fire resistant movable closure means operatively associated with the aperture, the closure means being movable between a first retracted position and a second functional position wherein the aperture is closed-off by the closure means, self-sustaining restraining means of a heat disposable low-temperature melting metallic substance, the material being dispersible into a non-sustaining form when heated above the melting temperature thereof, the restraining means normally retaining the closure means in the first position while permitting the closure means to move to the second position when the substance is dispersed upon being heated, and means for normally urging the closure means into the second position.

This invention also provides in a building or like structure having a door assembly, the improvement wherein the door assembly includes a fire-stop associated therewith, the door assembly having a door movable between open and closed positions, said fire-stop having a movable fire resistant barrier movable between a first non-door blocking position in which the barrier is off-set from the door and a second position in which the barrier is effective to close off the door, self-sustaining restraining means

for normally retaining the barrier in the first position, the restraining means comprising a heat-disposable low temperature melting metallic substance, the substance being dispersible into a non-sustaining form when heated above the melting temperature thereof, and means for urging the barrier against the retaining means and for urging the barrier into the second position when the restraining means no longer retains the barrier means whereby the barrier means may then be urged into the second position.

A still further application of the present invention relates to an air-conditioning system having fluid-carrying ducts and fluid-flow interruption means (e.g. air being an example of such a fluid) for closure of fluid-flow in the ducts, the system comprising at least one duct for fluid flow, fluid-flow interruption means movable between first and second positions in which the first position is a non-fluid-flow interruption location and the second position is a fluid-flow interruption position, the interruption means comprising fire resistant barrier means, self-sustaining restraining means of a heat-disposable low temperature melting metallic substance, the substance being dispersible into a non-sustaining form when heated above the melting temperature thereof, the restraining means normally retaining the fluid-flow interruption means in the first position, and means for normally urging the fluid-flow interruption means into the second position while restrained from movement into the second position by the restraining means.

In the above devices applicant has found that by employing a load bearing non-combustible disposable and dispersible material of metallic alloy or substance which has a low melting temperature, to retain the movable closure or barrier means in a retracted or first position, the closure means can act in a positive manner to seal off the aperture and thus provide a positive fire stop; in this way, the more desirable thermoplastic piping which can be used for conduits, can be brought right up to or adjacent an aperture and indeed, can be coupled to the device of the present invention.

Preferably, the disposable heat-dispersible means surrounds, at least in part, an aperture which extends through a fire wall; it may comprise a fire resistant first housing surrounding the aperture with an optional extension through the aperture of the fire wall. Another form comprises a complete housing surrounding the aperture, although the housing may only partially surround the actual opening depending on the type of movable closure means.

The load bearing dispersible restraining means releasably retains the closure means under normal conditions in a non-operative condition, and releases the movable closure to move from the first to second positions, so that effective passage through the aperture in the fire wall is not blocked by the dispersible means while at the same time permitting free movement of the closure means so there is no obstruction to its movement due to the dispersible means.

In contrast to the prior art, the quantity of heat-dispersible means forming the housing is such that a minimum of material may be employed. The

material used may be e.g., a metallic alloy or other substance which melts at low temperature. The particular type of alloy employed may vary in composition depending on the particular application; typically, e.g. bismuth based alloys containing various ratios of bismuth, and alloying materials such as lead, tin, cadmium, antimony and the like can be used as can lead-tin alloys containing alloying elements of e.g. antimony in various ratios. Typical of such dispersible products which may be utilized are those marketed under the Trade Marks "Cerroband"; "Cerro-matrix"; "Cerrocast"; "Cerrotru" and the like.

It is essential that the metallic substance be heat disposable and dispersible at low temperatures into the non-sustaining form when heated above melting temperature of the substance, and without combustion. This is characteristic of the above type of metallic substances where at normal temperatures, they are solids which can be shaped into a desired form. Such substances also have relatively short melting points so that when heated to the melting point to become dispersible, they change from a solid to a liquid and are capable of dissipating to thus become non-sustainable and permit the closure means to function.

Depending on the installation the particular heat-disposable material will be selected to have a different melting point for different applications. In most residential applications, the heat-disposable material will melt below e.g. 175°C; in the case of industrial applications the heat-disposable means will melt at e.g. 230°C or below due to higher temperatures normally encountered in the operating environment.

The heat disposable and dispersible component may have various forms and shapes; in the case of a fire stop in a fire door, it may be a plurality of pins associated with the building structure and be directly or indirectly mounted relative thereto; e.g. one or more brackets of heat-disposable material may be used to support or retain a door in a first position. For a window, one or more pins secured to a wall may support the closure or barrier. The barrier restraining means can also be an angle bar e.g. an "L-shaped" member. Normally, low temperature melting substances of the type described possess good mechanical strength to retain weight; the amount of heat-disposable material employed can be minimized so it is sufficient to retain not only the closure or barrier but also counter the force of the means urging the barrier into a closed position.

One feature of the present device is that the material which is low melting must be "disposable" - that is, such material must, when heated, form a flowable form, e.g., liquid in which the liquid dissipates from around the aperture through the fire wall. In this manner, the material does not hinder the closure of the closure means. Likewise, by using a low melting alloy, once subjected to use, the material is disposable so that a "fail-safe" system can be achieved so that the device cannot be put back into operation without installation of a new component.

In forming a housing for the disposable low temperature melting alloy, its shape can be formu-

lated to modify the heat response of the device of the present invention by utilizing various metals to form the low temperature melting substances or alloy or by the size of the housing which will affect the heat pick-up - and consequently, its sensitivity. The housing may be modified to provide a collar or other point of attachment for any thermoplastic conduit extending up to the housing, so that the thermoplastic material does not enter into the fire wall zone.

The closure/barrier means can be any suitable form operating in conjunction with the heat-disposable component so as to effectively close the aperture in the fire stop when released by the heat-disposable material. Thus, a gate or plate dimensioned to cover the aperture, when moved from its first restrained position to a second operative position can be used. The gate/plate may be within a fire-resistant housing which may partially surround or be associated with a housing formed of the heat disposable material; the housing for the closure means protects it against accidental damage or jamming during installation and use, and functions to guide the closure means upon activation into the desired position.

The closure plate housing and the closure plate can be of any suitable material which meets the necessary requirements e.g. fire resistant or non-combustible materials - these are generally rigid and capable of withstanding the heat encountered during a fire. Typically, sheet metal e.g. steel, engineering type thermoplastics or thermosets can be used.

The housing can have guide means for the closure plate to assist it during movement from the first to second positions, such as channels accommodating the closure plate. The guide means may include apertures permitting the heat disposable material, when rendered flowable by a fire, to escape from the channels.

For "universal" application - i.e. a horizontal, vertical or angled disposition, means for urging the closure means into contact with the heat-fusible means is provided. This can be a spring such as compression or tension spring or other loading means such as hydraulic or pneumatic accumulators, Bellville washers, etc. Weights may be connected to or associated with the closure means to normally urge the closure means against the fusible means.

Where the barrier/closure is a slidable barrier mounted above a door a spring may not be required as the weight of the barrier, when the heat disposable means is rendered non-sustainable, will be sufficient to permit it to "fall" into position - generally using guides such as channels located beside the door opening. Conversely, where barrier means are employed for doors or openings, and even in the case of barrier means for safety windows, lateral or side mounting of the fire stop devices can be used with a spring to displace the barrier means from a first inoperative position to a second operative position.

When the fire stop is in an air-conditioning duct or the like, the barrier/closure means forming an

air-flow interruption device will usually be mounted externally. The barrier can conform to the duct contour and be relatively tight fitting (or not, as required) as, for example, by applying a seat against which the barrier is adapted to be placed in juxtaposition.

Having thus generally described the invention, reference is made to the accompanying drawings illustrating preferred embodiments:

Figure 1 is a cross sectional view through a fire stop device of the present invention in a fire separation wall;

Figure 2 is an end elevation showing the device of the present invention;

Figure 3 is a front elevation of a fire stop device in a fire door;

Figure 4 is a section on 4-4 of Figure 3;

Figure 5 is a front elevation of a fire stop device in a door opening in a wall;

Figure 6 is a section on 6-6 of Figure 5; and

Figure 7 is a front elevation partially in cross-section of an air-conditioning system having the fire stop device.

As shown in Fig. 1 a device 10 of the present invention of a fusible alloy material e.g. lead-antimony alloy, is shown in a cylindrical tube form and passes through an aperture in a fire separation zone. Tube 10 forms a housing projecting beyond one end of the wall to form an engagement surface 12 with a further extension 14 forming a shoulder for a thermoplastic coupling assembly. Pressure seals may optionally be included in the assembly to allow leak-proof passage of fluids, e.g. gases or liquids.

At its opposed end housing 10 has extension 16 to mount a further coupling or a thermoplastic fitting connection. Extensions 14 and 16 may have coupling 18 dimensioned to receive a conduit 20 of thermoplastic material, by mechanical or adhesive means.

Operating with the above is a closure assembly having a closure plate 22 mounted in housing 24. Housing 24, includes upper portion 24a, at least partially surrounding housing 10, of fusible material so that closure member 22 engages surface 12 of the fusible member.

Compression spring 26 mounted in housing 24 engages one end of the housing and also closure plate 22 for urging closure plate 22 into juxtaposition with fusible material 12.

Extension 30 of housing 24 surrounds fusible material 12 in the form of a channel for guiding and receiving closure plate 22 when it is activated by dispersal of the heat-fusible material 12 due to a fire. The bottom portion of the housing may include a seat 32 to receive closure plate 22; housing extension 30 may also include a plurality of apertures (not shown) to permit any heat-fusible material to disperse when it liquifies. Housing 24, extension 30, spring 26 and all other like components are intended to withstand the normal effects of a fire and are made of e.g. steel.

With the above arrangement, thermoplastic conduits of, e.g. ABS, PVC, high density polyethylene, low density polyethylene, and various types of rubbers (or thermoset compounds) can now be employed with the fire stops of the present inven-

tion, right up to the point where the fire stop is located adjacent e.g. a fire separation wall.

In the form illustrated, the heat-fusible alloy is a conduit 10 with extensions 12; that portion of the conduit extending through the fire separation wall need not be included or can be replaced with a conventional metallic or other suitable material conduit. The device is mounted against the fire separation wall by e.g., screws or the like which affix it to the fire separation wall. At the opposed side of the fire separation wall, conventional coupling means may be provided for mounting a plastic conduit up to the point where the conduit enters the opening through the fire separation wall with a connection to the dispersible metal conduit in the fire separation wall.

Figures 3 and 4 show a fire door 40 where e.g. a building wall structure has a conventional fire door with a conventional glass window 42. Fire-stop device 44 is provided for a window 42 which may be mounted adjacent it or can be installed vertically above or below the window 42, as long as it is arranged to protect the glass 42 during a fire.

Fire-stop 44 is mounted by a pair of spaced apart guide channels 46 provided on either lateral side. A barrier of fire resistant sheet material (e.g. metal plate) 48 is adapted to slide in channels 46 between a first non-operating position (as in Fig. 3) and a second operating position.

One or more (two being illustrated) restraining means 50 in the form of pins are provided in the door 40 adjacent window 42 and against which the fire-stop barrier 48 normally abuts. Pins 50 of a self-sustaining form are composed of the heat disposable low temperature melting metallic alloy material, as described above. Pins 50 may be e.g. cylindrical rods mounted directly or indirectly to door 40 but other forms may also be employed. In the event of a fire, the dispersible metallic alloy melts at a temperature below e.g., 450°F, and becomes dispersible into a non-sustaining form to release barrier 48 from its non-protecting position so that it may slide in front of the glass.

A channel 52 may be provided against door 40 to receive barrier 48 when in the operative position - thus providing stop means for positioning barrier 48 in a correct position.

Barrier 48 may have positive means for urging it against pins 50 and when the latter have dissipated due to heat generated by fire, into a closed or safety position in front of the glass in channel 52; thus, compression springs 54 in housing 56 can bear against the surface of barrier 48 to urge it against pins 50. Two or more such springs may be employed depending on the pressure-loading requirements for any given size of barrier.

In Figs. 5 and 6, the fire-stop device is utilized to protect a complete door; in these Figs. similar components are designated by similar reference numerals. Such an arrangement, as in an industrial or commercial building, has a door opening (with an optional door 60) in a wall W; it may have opposed steel channels or angle bars 46. A fire-stop barrier 48 is mounted adjacent door 40; in place of two pins 50 as in Fig. 4, either a plurality of such pins may be

employed or as shown, a self-sustaining strip 51 of the metallic alloy of a thickness and size capable of restraining the barrier 48 is mounted on the wall against which the barrier 48 rests in its non-functional position (Figure 6). No bottom channel is required in this arrangement to support 48 in a closed position as typically the floor F will function for this purpose.

In Fig. 7, the fire stop device is in a ventilation system for buildings or the like. Thus, air-conditioning duct 61 carrying air is typically located between a roof assembly 62 and a ceiling 64. To meet different requirements, it is necessary to provide a fire stop between two adjacent building sections, or in other cases, between two adjacent rooms 66 and 68, otherwise separated by means of a wall 70. For this purpose, the fire stop device employs the structure illustrated in greater detail in Figures 1 and 2. Thus, adjacent sections of the air-conditioning duct 61A and 61B are spaced apart by a coupling 10 (Figure 1) which may be employed for joining the sections 61A and 61B; the fire stop device is otherwise contained in a housing 24 mounted externally and above ducts 61. A housing 25 may enclose the sections 61A and 61B and extend on both sides of housing 24. The above device functions as described in Fig. 1 so that the heat disposable material, upon being melted, will permit barrier 22 to pass between the duct sections 61A and 61B to close off the flow of air therethrough.

The arrangement of Fig. 7 may also employ electrically implanted or embedded heating means surrounding the conduit 10 joining the duct sections, which can be actuated from a remote position, to automatically cause the heat disposable material to be dissipated and permit automatic closure of the barrier to shut-down the air-conditioning system. Alternatively, any heating means employed can be mounted interiorly or exteriorly of the conduit in place of being embedded in the conduit.

In plumbing applications, the above described fire-stop device may be used in, e.g., multi-storey buildings, where it is desirable to isolate communication not only between adjacent units on the same floor but also between adjacent floors in the same building; thus the device can be employed with conventional plumbing systems to provide a fire stop at plumbing junctions at floor or wall levels.

The device can also be employed in, e.g. doors or other like sections in factories where windows are used. At present, for fire protection, heavy metal shutters are utilized to protect doors with windows; in place of such shutters, the device herein may be automatically released in the event of a fire thus eliminating fairly heavy structures and making such installations more economical.

Applicant's device can also be combined with secondary shut-offs in industrial conduits carrying industrial fluids where the heat-dispersible means can be provided with heat-inducing wiring (either externally or internally of the heat-disposable means) which may be thermally, manually or automatically activated by remote or direct control means. Thus, in a building having the closure devices selected fire stops (or all of them) may be provided with heat conductive wiring to cause the

heat-disposable means to become non-self-sustaining when desired.

The device may also be modified by including severing means for cutting, telephone or communication lines where they are installed through a fire separation. Upon activation of the closure means, a knife-blade attached to the closure means can thus sever such lines and provide an effective seal without interference from wires passing through the fire separation zone. Alternatively, the closure means may directly incorporate a knife so that, e.g., its leading edge can sever any wires.

Claims

1. A fire wall safety structure suitable for closure of a conduit passing through the firewall comprising fire resistant movable closure means for operative association with an aperture, said closure means being movable between a first retracted position and a second functional position wherein said aperture is closed off by said closure means, self-sustaining restraining means of a heat disposable low-temperature melting metallic substance, said material being dispersible into a non-sustaining form when heated above the melting temperature thereof, said restraining means normally retaining said closure means in said first position while permitting said closure means to move to said second position when said substance is dispersed upon being heated, and means for normally urging said closure means into said second position.

2. The device of claim 1, wherein said heat-dispersible restraining means forms a bearing surface against which said movable closure means is normally urged, or comprises a housing or collar adapted to surround, at least in part, an aperture through a fire separation wall.

3. The device of claim 1, wherein said movable closure means and said means for urging said closure means are mounted in a protective housing.

4. A device as defined in claim 1, 2 or 3, wherein said means for urging said closure means against the heat-fusible means comprises a compression or tension spring.

5. In a building structure having a structural opening requiring fire stop protection, the improvement wherein said opening has a movable fire resistant barrier dimensioned to at least substantially cover said opening when moved from a first non-protective position to a second protective position, in combination with restraining means retaining said fire resistant barrier in said first non-protective position, said restraining means comprising a heat-dispersible low temperature melting metallic substance, said substance being dispersible into a non-sustaining form when heated above the melting temperature thereof to release said fire

resistant barrier to permit the same to move into said second protective position.

6. The device of claim 3 wherein the structure has a door assembly, and wherein said door assembly includes a fire-stop associated therewith, said door assembly having a door movable between open and closed positions, said fire-stop having a movable fire resistant barrier movable between a first non-door blocking position in which said barrier is off-set from said door and a second position in which said barrier is effective to close off said door, self-sustaining restraining means for normally retaining said barrier in said first position, said restraining means comprising a heat-dispersible low-temperature melting metallic substance, said substance being dispersible into a non-sustaining form when heated above the melting temperature thereof, and means for urging said barrier against said retaining means and for urging said barrier into said second position when said restraining means no longer retains said barrier means whereby said barrier means may then be urged into said second position.

7. The device of Claim 1 wherein the structure is incorporated into an air-conditioning system having air-carrying ducts and air-flow interruption means for closure of air-flow in said ducts, said system comprising at least one duct adapted to carry a source of air, air-flow interruption means movable between first and second positions in which said first position is a non-air-flow interruption location and said second position is an air-flow interruption position, said interruption means comprising fire resistant barrier means, self-sustaining restraining means of a heat-disposable low-temperature melting metallic substance, said substance being dispersible into a non-sustaining form when heated above the melting temperature thereof, said restraining means normally retaining said air-flow interruption means in said first position, and means for normally urging said air-flow interruption means into said second position while restrained from movement into said second position by said restraining means.

8. The structure of Claim 5, wherein said structural opening comprises a door opening in a wall; a safety window in a wall or door; or an opening in a wall having a door associated therewith.

9. The structure of claim 1 or 5, wherein said low temperature melting metallic substance includes heating means associated therewith, said heating means being adapted to heat said substance to a temperature sufficient to dissipate said substance into a non-sustaining form.

10. The air-conditioning system of claim 7, wherein said interruption means comprises a damper positioned within said duct, said restraining means normally retaining said damper in a position to permit air flow in said duct.

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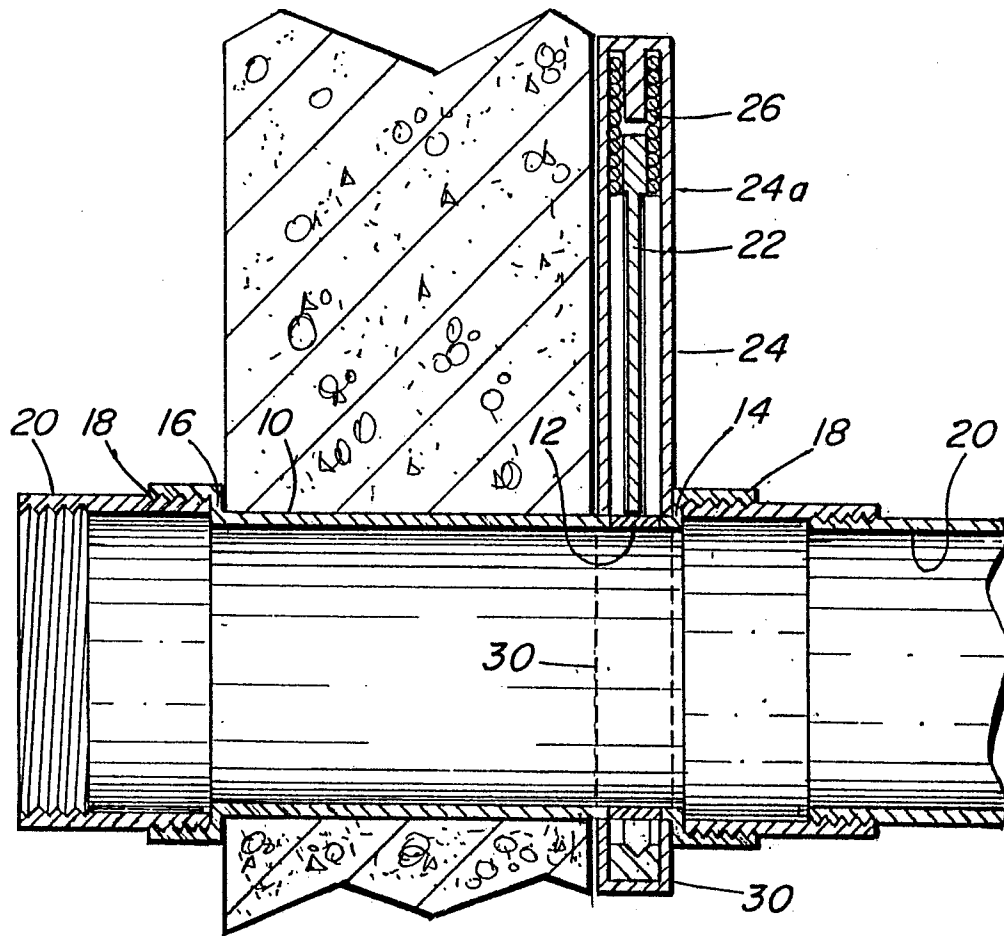


FIG. 1

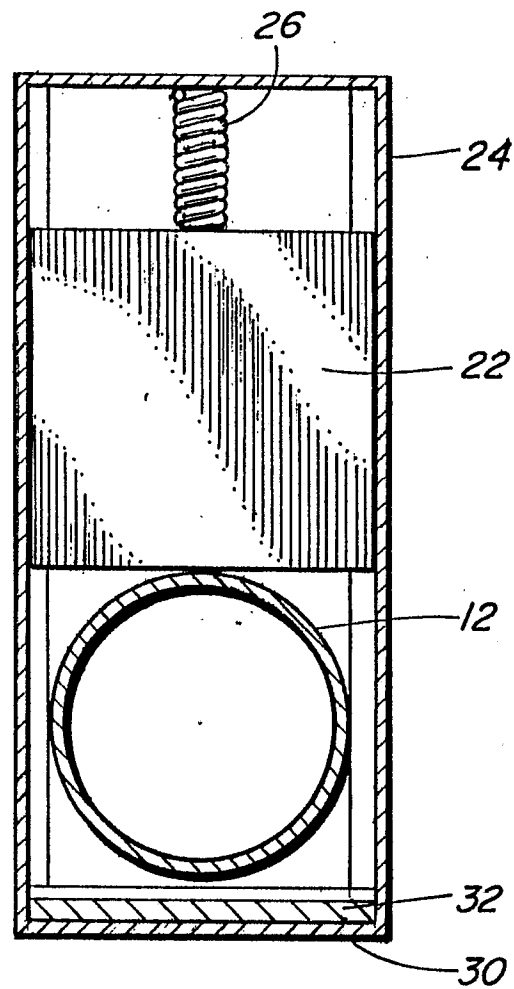


FIG. 2

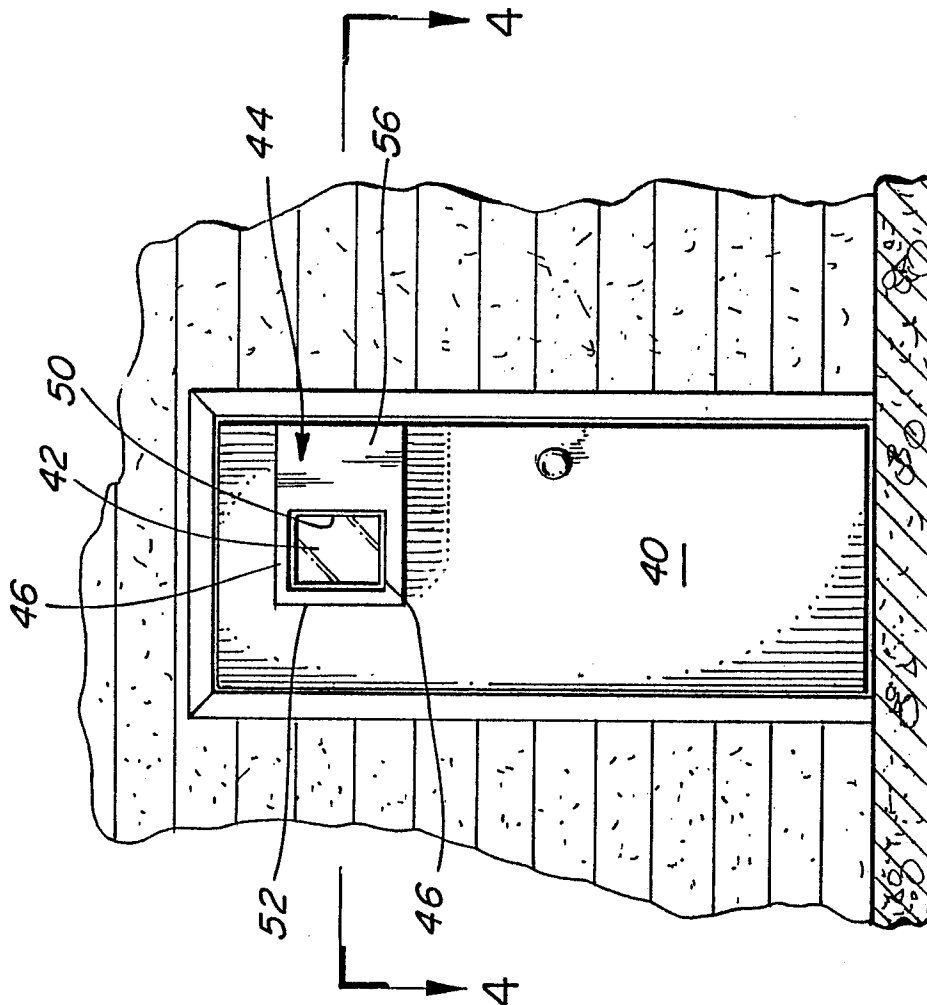


FIG. 3

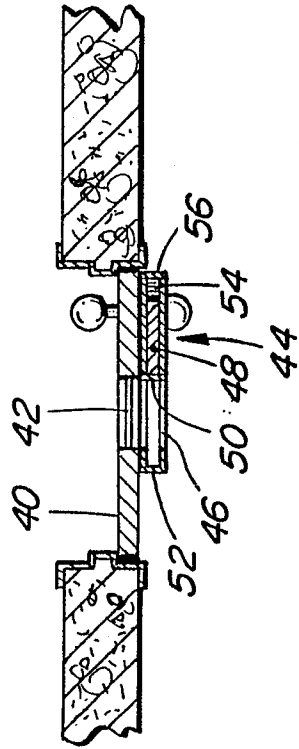


FIG. 4

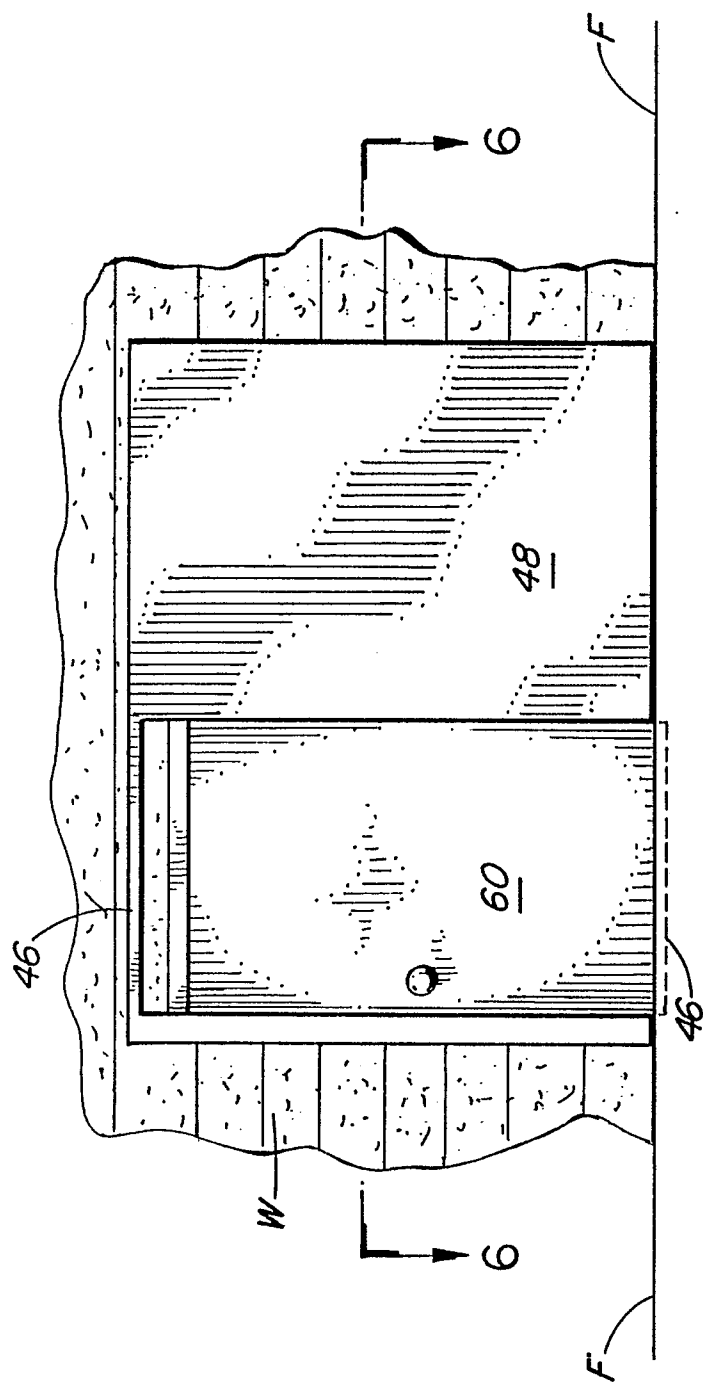


FIG. 5

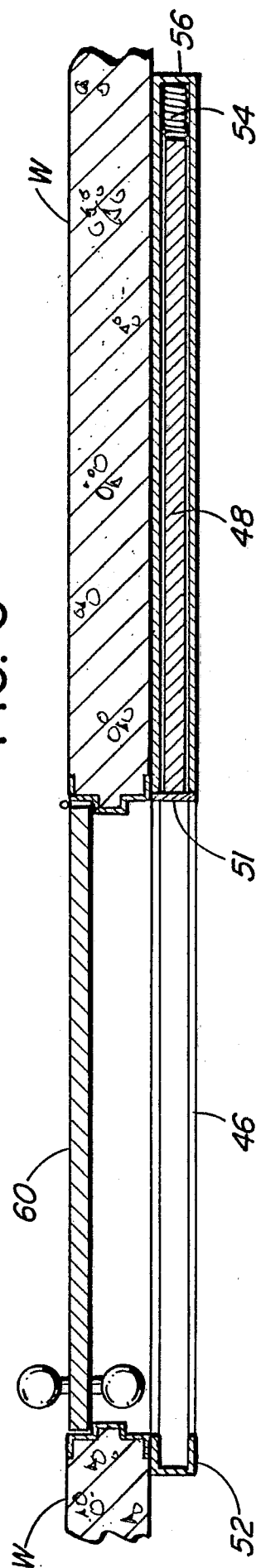


FIG. 6

FIG. 7

